# XOXO or XX/XY? Gender Essentialism and Queer Exclusion on Dating Apps

KATY WEATHINGTON, University of Colorado Boulder, USA
MORGAN KLAUS SCHEUERMAN, University of Colorado Boulder, USA
JED R. BRUBAKER, University of Colorado Boulder, USA

In a world with shrinking queer spaces, dating apps serve as a useful way to find romantic or sexual partners, make friends, and develop connections in an often fragmented community. However, dating app structures may exclude queer users more than their cisgender heterosexual counterparts. In this paper, we examine how gender and sexuality are formatted as data in dating app profiles and algorithmically curated matchmaking functions. Based on an analysis of ten popular dating apps, we found gender and sexuality were often divided into descriptive labels and functional categories, which systematically marginalize or exclude queer identities from the matching process despite appearing inclusive. We present a framework for identity on dating apps, disentangling identity into a multi-layered construct of data schemas, profiles, algorithms, and platform ideology, thus enabling designers of data-driven systems to identify salient factors for users, even beyond queer identities and dating apps.

CCS Concepts: • **Social and professional topics → Gender**; **Sexual orientation**.

Additional Key Words and Phrases: Dating Apps, LGBTQ, Queer HCI, Queer Data

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## 1 Introduction

Dating is hard. That's why over half of young people in the United States have used dating apps [30]. Dating apps provide an alternative way to meet new people, all through the convenience of a phone. Dating apps have grown to be used by some 337 million people in 2023 [15]. Of course, not everyone's dating app experience is the same.

Consider these hypotheticals. Kristof has not had much luck with offline dating, so he decides to try dating apps. He puts in his basic information, like his name, date of birth, and location. He is then asked which gender best describes him. He easily picks "man," barely registering the "woman" and "more options" buttons. He is then prompted for his sexuality. There is a list to choose from, but "straight" is conveniently at the top, which he selects immediately and moves on. Next, Kristof is asked who he wants to date. Being straight, he selects women. He then happily starts swiping

Authors' Contact Information: Katy Weathington, University of Colorado Boulder, Boulder, CO, USA, katy.weathington@colorado.edu; Morgan Klaus Scheuerman, University of Colorado Boulder, Boulder, CO, USA, morgan.scheuerman@colorado.edu; Jed R. Brubaker, University of Colorado Boulder, Boulder, CO, USA, jed.brubaker@colorado.edu.

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through a queue of potential matches. Kristof's experience reflects what is typical for a cisgender[1], heterosexual[2] man making a dating app profile.

Nyx, meanwhile, is a non-binary person, and their experience is not nearly as smooth. When Nyx is confronted with "man" or "woman," they are relieved to spot the "more options" button, using the search bar to consider the handful of options available. Settling on "non-binary," they are glad to move on... until they are confronted with a binary choice: to be included with either men or women. Nyx now understands that this binary choice is unavoidable and will determine who sees their profile. While feeling annoyed at the ultimatum and queasy at the thought of being misgendered [3], Nyx ultimately chooses "woman," which feels like the best choice for meeting the right people, despite also feeling more invalidating of their identity.

While these narratives are speculative, they demonstrate the considerations and difficulties queer users may face: where Kristof had an easy time creating his profile and finding women to swipe through, Nyx faced complications at every step of the process. For every prompt on the app, queer users have to contemplate how they could best represent their identity within a system that is not conducive to those outside the cisnormative gender binary [4]. The app requires them to delicately balance authenticity and usability to find and be found by the most compatible people.

Prior work has found online dating is a widely accepted and important avenue for queer people to make connections [12, 33, 38, 39]. Often, queer users congregate on queer-specific apps to avoid harassment and minimize concerns of being outed [38]. However, as demonstrated by the examples above, creating data-centric technology that lets people express themselves appropriately is not always straightforward [36], a concern that is heightened in the context of interpersonal and romantic connections. The characters above are fictional, but demonstrate how experiences can differ between those who fit a cishet norm that apps are generally designed for and those whose queer identities subvert common assumptions. The app flows above were modeled on Tinder, yet all dating apps employ gender and sexuality in ways that enable and constrain different users. The simplicity with which gender and sexuality are presented belies the complexity of how users are handled in the matchmaking algorithms of dating apps, and the compromises that queer people must make when fitting themselves into these platforms.

In line with calls to explore the needs of queer communities and queer approaches to design [17, 22, 23], we sought to better understand the impacts of datafication [5] on queer identities. We performed a systems walkthrough [28] of ten dating apps to understand how gender and sexuality were categorized and represented in each app. Specifically, we examined how apps structure user data, display user profiles and posts, enable filtering and sorting, and ultimately enforce how user-to-user interactions take place. We found that gender and sexuality are employed both as profile labels and as categories for algorithmically curated matchmaking. We discuss how the structuring of gender and sexuality as labels and categories negatively impacts queer users in particular.

We argue that a significant reorienting of dating apps is necessary to improve queer inclusion. People with queer identities are currently forced to use systems that make trade-offs between accurate representation and effective matchmaking. In our discussion, we explore these trade-offs by presenting a framework that describes how identity is operationalized and used across four layers. We describe (1) the calcification of identity in the Data Schema Layer; (2) the flexibility of identity presentation in the Profile Layer; (3) the organization of identity in the Algorithmic Layer;

[1]A term referring to people who identify with the gender they were assigned at birth.
[2]We shorten cisgender heterosexual to cishet throughout this paper, using it as an umbrella term for people who are not queer.
[3]The purposeful or accidental reference to a trans person as the wrong gender.
[4]A normative conceptualization of gender as strictly man or woman, aligning with sex assigned at birth.
[5]The process of turning information about peoples' lives into data for use in broader technical systems.

and (4) the larger cultural norms about identity in the Ideological Layer. Our four-layer framework is aimed at helping dating app designers, specifically, and database designers, more broadly, design identity in ways that are meaningful to user interaction, rather than algorithmic sorting.

## 2 Related Work

Our research is situated in the overlap of three threads of scholarship: (1) the experience of (queer) people on dating apps, (2) the schematization of identity for technical use, and (3) the reinforcement of gender binaries in technical systems. We start by showcasing how scholarship about (queer) dating apps focuses on the interpersonal experiences that occur between users but fails to delve into how the structure of dating apps shapes those experiences. We then describe prior research that explores the social implications of structuring identity (often, gender identity) for technical systems, which we build upon to include dating apps.

### 2.1 Experiences on (Queer) Dating Apps

Dating apps are one of the most accessible ways to meet people, no longer leaning on friends and family to make connections, but rather, requiring only internet access and time [34]. The popularity of dating apps has reinforced their use, in what De Ridder calls "the datafication of intimacy" [16]. Dating apps exist for and cater to endless communities. These niche dating apps help individuals find a sense of community and foster connections based on aspects of their identity they find central to their dating life. Dating apps have become so widespread that 30% of all Americans report having used a dating app or site [30].

However, people do have reservations about using dating apps. McClain et al. [30] found that many people express discomfort at the idea of using dating apps or have had a negative experience. People often struggle to make meaningful connections [30]. For many, dating apps do not end up leading to a relationship [30]. Safety is also a major concern for those meeting someone off an app, particularly for women or those from marginalized groups [30]. Furthermore, dating apps can reinforce social biases. A study by Brinkhurst-Cuff found that racial biases are reflected in choices to swipe left or right, with Black women having the lowest rate of likes, especially from white men [10].

Despite their shortcomings, dating apps provide a way to make connections that may not exist otherwise. Given the additional challenges queer individuals face when trying to find romantic partners compared to their cishet counterparts [7, 31, 44], dating apps have seen strong adoption by the queer community [38]. Dating apps allow people in seemingly small or dispersed dating markets, such as queer people outside major cities, to initiate connections well beyond the scope of in-person interactions [38]. For queer groups which lack accessible in-person physical spaces, such as lesbians, dating apps offer an enticing proxy [39]. Beyond merely romantic connections, research has found queer users also leverage dating apps to develop platonic connections [12, 33]. Of course, like their cishet counterparts, queer people have negative experiences with dating apps as well. Researchers have documented experiences of outting, fetishization, exclusion, and harassment [7, 24, 41, 42].

Given that dating apps are premised on making romantic connections between users, users of dating apps must curate their self-presentation, which is an especially salient concern for queer users. In Ferris and Duguay's examination of queer use of Tinder [20], they describe "Gay Tinder" as an unattainable digital imaginary for WLW[6] because their queues are filled with heterosexual men, couples looking for thirds, and heterosexual women looking for friends; the lack of an exclusively

[6]Women-loving-women, a term for women who are attracted to other women, which includes both lesbian and bisexual women.

gay space spurred queer users to develop more intricate and salient forms of identity signaling. Similarly, Birnholtz et al. found that queer men on Grindr utilized euphemisms for casual sex to avoid slut-shaming while also communicating desires, balancing their presentation between an imagined audience and the real audience [2]. Trans users are especially concerned with their self-presentation, as they have to consider their desires for safety in deciding whether to proactively disclose their trans identity [19]. Yet, despite the need to curate self-presentation for romantic connections, Zytko found dating app users fear rejection when making profiles that give highly accurate self-presentations [46]. Blackwell et al., similarly found that dating apps collapse behavioral norms of physical queer spaces (i.e. gay bars), and create tensions between self-presentation and privacy for queer users who may have to address multiple audiences simultaneously [6].

As evident from this prior work, the way that dating apps are designed shapes the experiences users have with them. In terms of understanding queer relationships, dating apps present a compelling site of study because at the core of their very functionality is the gender and sexuality of users. We extend prior research which has focused on user experiences with dating apps by focusing specifically on the data structures and schemas fundamental to dating apps. Dating apps structure how queer identities can be presented, and thus the types of user-to-user interactions that can occur on them. We reveal how gender and sexuality result in different functionalities and interactions for cishet and queer users.

### 2.2 Schematizing (Queer) Identity

At their core, dating apps schematize identity. A user making a profile must translate aspects of their identity into data [11] — the majority of which is highly structured and standardized. Schematizing identity for the sake of enabling some underlying computational function is core to sociotechnical systems, from social media to algorithms. As a result, there is an abundance of work in social computing scrutinizing how identity is schematized, particularly in the context of AI/ML. How queer identity is schematized has been central to this work. For example, Scheuerman et al. examined how gender is schematized and operationalized in facial analysis software [37]. Prior research has also showcased how queer identities are schematized on Wikidata, a database sister project to Wikipedia [43].

Extensive research has examined how identity in technology design perpetuates a cisnormative gender binary. For example, Bivens and Haimson [3] performed a walkthrough analysis of popular social media platforms, finding that the cultural norm of the gender binary is perpetuated through gender fields which are structured as male, female, or a third option, typically implemented as either "unspecified" or "all." Scheuerman et al. found that many gendered web forms did not offer non-binary gender options, systematically excluding non-binary people from equal access to technical infrastructure [36]. Bouma-Sims found design decisions "baked in" a binary conception of gender, even when such classifications were hidden from the front end [8]. The gender binary was also perpetuated within dating apps. Garritano found that the interfaces and infrastructures of Tinder and Bumble perpetuate cisgender, heteronormative values [21]. MacLeod and McArthur also found Tinder and Bumble perpetuated a gender binary [29]. Beyond merely the data of gender, Comunello et al. found that the affordances and constraints of dating apps influence how users perform their gender in culturally recognizable patterns, or "scripts," which typically reified stereotypical gendered behavior [14].

How identities are translated to a data schema (how data is organized, structured, and related within the database structure of a system) affects what people can do with a technology or on a platform. The data affordances of platforms directly impact what types of interfaces and interactions are possible [18] and how people interact socially [11]. These data attributes determine how individuals position themselves within a broader social ecosystem of a platform or digital space.

Prior research has shown that people fasten their identity across multiple platforms, engaging with distinct profiles and social networks [45]. Different platforms with different data affordances directly result in different representations of the individual and different modes of interaction.

Campaioli identified two opposing forces in the categorization of gender on social platforms: users choose gender categories to create a self-reflective profile that is intelligible to other users and algorithms, while platforms are motivated to offer options in line with commercial opportunities, advertising, and collecting data to sell to third parties [13]. MacLeod and McArthur, in their study of Tinder and Bumble, argued that gender was intended only to determine which profiles to show [29]. DeVito et al. found a disconnect between the perceived values of platforms and the values of their marginalized users, identifying self-determination and inclusion as the two main community-based values for supporting LGBTQ+ users [17]. Considering the effects of gender categorization, Bivens and Hoque examined a feature on Bubble where only "women" can message first [4]. They argued that this feature served as a calcification of the company's white, cis-hetero-feminist ideology.

Though these studies have established the perpetuation of gender binaries, in both dating apps and broader technical systems, they have tended to overlook sexuality and its role in gendered matchmaking interactions common in dating apps. We build on this work to better understand the role that both gender *and* sexuality data play in ostensibly simpler data systems. Dating apps also exist as an ecosystem, with the same user often employing multiple apps [30] with different data schemas for the same goal: making a connection. To understand how the schemas deployed in many dating apps affect potential users, we turn to Bowker and Star's notion of *torque*. As defined by Bowker and Star in [9], torque describes the "nightmare texture" which results from one's identity being misaligned from the classification system in which it is forced to fit. Koopman refers to this forced fit into a classification system as a "fastening" [27]. An individual who wants to participate in a given data-driven system is forced to conform to their data standards, or else be unable to access that system. We examine the underlying classification systems used in dating apps and how users being fastened to those systems may experience torque as a result.

## 3 Methods

To understand the construction of queer identity in dating apps, we conducted an in-depth technical analysis of ten commonly available dating apps. Informed by infrastructural analysis [40], we studied ten dating apps with a focus on developing a broad understanding of the datafication of gender and sexuality. In this study, we performed a walkthrough analysis [28] of ten dating apps. By performing a walkthrough, we mimic the user flow that would be experienced by users with various identities and explore the agency of identity presentation afforded to the user. We examined data fields for gender and sexuality, and the role of gender and sexuality data in algorithmic matchmaking. By examining these data fields, we can identify what queer identities can be modeled in each app's data structures, what identities may cause individuals to experience different user flows, and infer how these data models may propagate to the dating function of the app.

### 3.1 Selection of Dating Apps

The apps we analyzed are divided into two groups consisting of five apps each: those catering to a general audience and those catering specifically to queer populations.

For general dating apps, we chose five apps that were highly ranked (top ten) on both the Apple and Google store dating app pages. Apple and Google's stores rank these apps based on a black box algorithm which many believe includes download count and active user engagement [5, 35]. Regardless of how app store rankings were determined, these apps were highly visible because of their ranking. Furthermore, when selecting general dating apps, we excluded apps that catered to a particular demographic or affinity/identity group (e.g., Farmers Only).

For LGBTQ+ dating apps, we aimed to collect a diverse, yet still popular set. We solicited recommendations from queer community members who were part of the first author's online queer community spaces and asked which dating apps they used for finding queer dates. Approximately ten community members responded. They ranged from early 20s to mid/late 30s and had at least some current or prior experience using queer-specific dating apps. Their responses provided us with a short list of apps from which we selected five. As with our non-queer set, we prioritized apps that were highly ranked on app stores (such as Grindr). Furthermore, we prioritized apps that were repeatedly mentioned (and used) by queer community members regardless of app store metrics. Given our interest in different ways of representing identity information, we also prioritized apps with novel and atypical designs. As a result, we included some newer platforms with smaller user bases (e.g., Lex).

We limited our analysis to those apps without a paywall or the free portion of the app. Additionally, because the research team spoke English as a first language, we limited ourselves to apps with a significant English language user base and English interface.

Our final set of apps can be seen in Table 1. Since our initial data collection in May 2022, a number of our dating apps have updated how they implement queer-related identity concepts. To account for this, we routinely checked for changes to incorporate them into our analysis. Unless otherwise specified, we describe each app as of June 2023.

### 3.2 Analysis of Dating Apps

Extending Light's walkthrough method [28], we performed walkthroughs of account setup and profile creation. We exhaustively explored every type of data that could be provided and how those choices impacted the functionality of each app.

We first documented the steps of initial account and profile creation. For each field, we recorded data prompts, whether responses were required, what response values or types were allowed, the number of response values allowed, and (when multiple responses were allowed) tested combinations of responses. Throughout we focused on if and how any particular responses prevented others (for example, testing if the user could select both "man" and "woman" simultaneously), and recorded whether users had an option to specifically hide or show their response on their profile. We also reviewed profile options after the initial account and profile creation. Specifically, we reviewed data prompts available to users when editing a profile and in the app settings.

We next explored how account and profile data impacted what profiles were shown to the user. Following the design of the platform, we did this either by swiping through profiles in the queue, reviewing the top visible users on the grid, or reading through the post feed. We then tested the impact of changes to responses to individual fields and combinations of fields about sexuality, gender(s) the user is interested in seeing, and (when apps allowed) changes to the user's selected gender(s). With each combination, we re-examined what profiles were shown. Changes were almost always immediate and obvious, especially when alternating between responses that indicated exclusively men or exclusively women. Likewise, it was typically obvious if the change had no impact, as the same profiles that had been visible before were still visible after the profile/settings changes. However, in all cases, we carefully navigated through the queue, grid, or feed to identify less obvious edge cases.

During analysis, we started by documenting data schemes for each app based on our data collection. We first focused on the account and profile schemas, including every data prompt [7], the allowed responses, the number of responses, specifications that could be made upon responses (i.e., on Bumble, non-binary gender can be additionally specified as genderqueer), and what data was

[7]The data field as presented to the user, often in the form of a prompt or question.

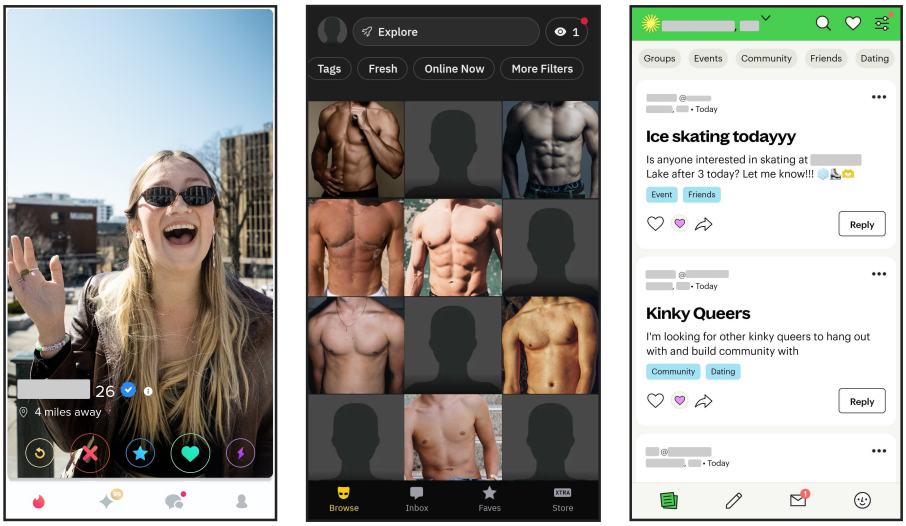


Fig. 1. Representative fabrications and examples of the three primary forms of displaying user profiles. Tinder's queue (left) displays one profile at a time. Grindr's grid (middle) displays multiple user thumbnails simultaneously. Lex's feed (right) displays posts made by users.

required or not. We exhaustively examined app schemas for common patterns, with a close eye on data related to gender and sexuality. These thorough close analyses identified the common types of gender and sexuality data that comprise our findings.

We further analyzed which apps had curated dating pools, or populations of profiles that may be seen or suggested to a given user based on any user filters, and whether those dating pools were curated by gender or sexuality. We could infer the role of gender and sexuality information in the creation of dating pools by examining how changes to gender and sexuality data fields resulted in changes to the dating pool. Naturally, the black-box algorithms almost certainly use additional data in curating profiles that we cannot know. However, by directly comparing dating pools after changing a singular data field input at a time, we could isolate the effect of each change, and therefore infer the role played by that field when all other data was held constant. For instance, we saw no changes in the dating pool on Tinder when changing the sexual orientation field from "straight" to "lesbian." After seeing the same lack of effect with other values for sexual orientations, we could infer that the sexual orientation field was not used to curate dating pools on Tinder. Conversely, changing the response for gender(s) we are interested in from "men" to "women" had a clear impact on the dating pool. Repeating this with other interested-in genders and seeing similar effects, we can infer that interested-in categories were central to how Tinder creates dating pools for users. We looked for patterns between apps and focused on the role of gender and sexuality data, rather than other common filters of co-located dating apps (i.e. age and distance).

Users browse dating pools through one of three styles (see Figure 1). The *queue* is the most common form. Users are shown one profile at a time and must choose to either like it (typically, by swiping right) or reject it (conversely, by swiping left) before seeing the next profile in the pool. Two users who mutually like each other will match and have the opportunity to chat. The *grid* shows many profiles simultaneously as a grid of profile pics. Users may interact with any of these profiles in any order and need not match or like to send a message. The grid is usually sorted by

| *Dating Apps* | | | |
|---|---|---|---|
| Name | *Target Audience* | *User Interaction Formats* | *Gender-based Matching* |
| *Tinder* | Everyone | Queue | Yes |
| *Bumble* | Everyone | Queue | Yes |
| *Hinge* | Everyone | Queue | Yes |
| *OkCupid* | Everyone | Queue | Yes |
| *Facebook Dating* | Everyone | Queue | Yes |
| *Her* | Queer Women, Non-binary people, and Non-Cis Men | Queue | No |
| *Taimi* | All Queer People | Queue | Yes |
| *Grindr* | Gay men | Grid | No |
| *Scruff* | Gay men | Grid, Queue | No |
| *Lex* | Queer Women, Non-binary people, and Non-Cis Men | Feed | No |

Table 1. Dating apps we examined in our study, their primary demographic, and whether they had profile recommendation or curation which factored in user gender preferences.

distance and limited to those who used the app recently. Grids were seen in gay male-focused apps, Grindr and Scruff. The *feed* is unique to Lex and takes a very different approach to creating connections. Instead of showing user profiles, Lex creates a feed of text-only posts, written by users, resembling newspaper classifieds. Posts are displayed in the order they were made, with the ability to filter by poster age and distance. Posts can be liked, replied to, and if clicked will lead to the poster's profile.

In our findings, we focus on the way that gender and sexuality are implemented in dating apps. We specifically attend to how queer identities are operationalized into data. We exhaustively examined how data design choices cascade into the overall design and experience of each app. In our discussion, we further explore the consequences of how gender and sexuality are operationalized.

### 3.3 Researcher Positionalities

The authors all identify as members of the queer community. Multiple authors identify as transgender. All authors identify as homosexual or bisexual. The first and second authors have used dating apps, including many of the ones examined in this study. These identities give us subjective experience as queer people using dating apps, which gives us greater lived experiences from which to infer how queer users may encounter tensions at points of using these apps.

### 3.4 Limitations

There are four limitations to this study that we highlight here. First, we limited our analysis to English language apps, apps without paywalls, and apps without niche target users. Additionally, due to our Western origins, our study is limited to a Western (specifically, US) cultural understanding of gender and sexuality. Though we have an academic understanding of Indigenous gender identities

in non-Western contexts, we lack any embedded understanding of those lived experiences, which limits our analysis. Therefore our specific findings regarding gender and sexuality should not be taken as comprehensive.

Second, during analysis we were limited by the black-box nature of these algorithms when we inferred the role that gender and sexuality data fields play in the algorithmic curation of profiles. We could not know what other design choices were reflected in the algorithm, nor could we know what other data points or metrics were being considered. Though we have been told of some metrics used to recommend and sort user profiles, such as the likelihood a user will like them and the likelihood that other users will like the user back, we could not know the specific role of these metrics, nor how they were calculated, and thus did not factor such metrics, or any other hidden choices of the algorithm, into our analysis. Additionally, because the algorithm is a black box, we could not be certain that the changes made to gender or sexuality data fields caused the changes to the dating pool we observed. However, given the consistency of these behaviors, we find it unlikely that the identified changes to gender and sexuality data fields were not significant factors in the algorithm's behavior.

Third, it is worth noting that the gender and sexuality-related data had different structures (i.e. allowed options, number of responses allowed, etc.) between apps, therefore direct comparison of gender and sexuality effects on dating pools between apps could not be made. Rather, these data points and the algorithm had to be examined within the data constraints put forward by each app.

Finally, the work described here is not a user study, and we do not make claims as to the subjective experience of trans or non-binary people. Rather, we are limited to following the designed interactions that users with diverse identities would follow.

## 4 Findings

Gender and sexuality comprise the core of queer identities. Thus our findings focus on how gender and sexuality identities are encoded into dating apps. We describe the structure that gender and sexuality take, how each is used to group users, and how these groups are presented to other users in algorithmic matchmaking functions.

### 4.1 Gender

Dating apps capture gender in two data fields, each serving different purposes within the app: qualitative gender labels and technical gender categories. In the following sections, we use three terms to refer to the ways gender is conceptualized in dating apps:

(1) **Gender identity**: The identity held by a user outside the restrictions and context of the app.
(2) **Gender label**: A form of gender data that describes a user's gender identity, but which is not used by the app for sorting or matching. Most commonly displayed on a profile for users to read.
(3) **Gender category**: A class used to group people into dating pools and is used by the app's matching function

In our walkthrough, we saw that some apps would collect gender identity in two separate data inputs, which became visible when trying to put in a gender identity that was not in the primary two or three options provided (An example taken from Tinder can be seen in Figure 2). These tended to have two different sets of gender options, one of which would have significantly more options to select from than the other. We also saw that the input with more options tended to be displayed on the profile (or, the user would have the option to display it), while not appearing to impact the profiles being curated. Conversely, the data input with fewer options appeared to change the population of the curated profiles. We assigned the terms labels (for more options,

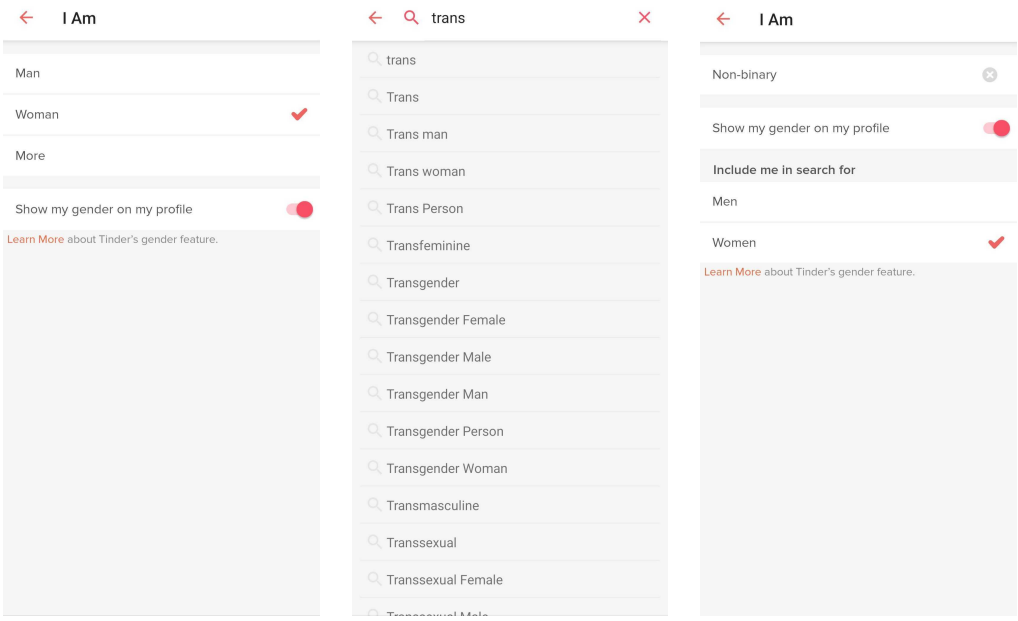


Fig. 2. Screenshots of gender input screens on Tinder. All users see the standard gender input screen (left). Upon selecting more, users are taken to a search bar with many gender options (middle). After selecting any of these options, users are required to select whether to be grouped with men or women (right).

which tended to appear on profiles) and categories (for fewer options, which tended to impact the dating pool) to these two different forms of gender data to differentiate between them, identify why gender was collected twice and differences in the usage of each.

Below we describe how gender identity is operationalized into labels and categories.

*4.1.1 Gender Labels.* Gender labels are calcified in data fields on dating apps, however, their primary purpose is not for sorting, filtering, or grouping users. Rather, they give users the ability to share their gender identity with other users who see their profile.

The major point of difference between how apps implemented gender labels was in the number of responses a user could have to each prompt. Apps fell into one of two camps: apps that limited users to one response, and apps that allowed users to choose multiple labels. On Her, for example, a single user could select both "woman" and "trans woman."

We also found that, on some apps, gender labels represented distinct gender identities, while on others there were redundancies and overlapping gender identities. When apps kept labels distinct, each label represented a different group of people, and labels strictly categorized people into distinct boxes. An example of this was seen on Facebook Dating, where men, women, and non-binary people are each non-overlapping identities.

Conversely, when labels were allowed to conceptually overlap, they tended to do so in ways that supported nuanced interpretations of identity concepts. For example, on Bumble, the "man" category could be further described with both "trans man" and "transmasculine." For some users, these terms might be interpreted as interchangeable; for other users, they might be interpreted as distinct. Therefore, users had more freedom to interpret gender labels in their own way. An even more stark example of conceptual overlap was seen on Scruff, where users could choose "cis

| | *Gender Labels* | |
|---|---|---|
| | *Number of Responses* | *Label Overlap* |
| *Tinder* | Single | Yes |
| *Bumble* | Single | Yes |
| *Hinge* | Single | Yes |
| *OkCupid* | Multiple (5) | Yes |
| *Facebook Dating* | Multiple | No |
| *Her* | Multiple | Yes |
| *Taimi* | Single | No |
| *Grindr* | Multiple (3) | No |
| *Scruff* | Multiple | Yes |
| *Lex* | Not recorded | Not recorded |

Table 2. Features seen in gender labels, including the number of allowed responses and whether labels are conceptually distinct.

woman" and "cisgender woman," which can be interpreted as two different stylings of the same gender identity.

It is also worth noting that apps do not have to include gender labels at all. Across the apps we studied, this approach was taken only by Lex. Rather than focusing on data-heavy profiles, Lex's design focuses on posts made by users. As such, Lex profiles have very little data. Instead, Lex allows users to write identity information in their bio, a free-text field where users can choose to introduce anything about themselves they feel is important. Many users indicate their gender in the "bio" field of their profile or in the posts they make.

Like Lex, all our dating apps had at least one free-text field where users can self-describe the aspects of their identities they feel are important. Where other apps differed from Lex is that the other apps had structured data fields collecting and displaying their identities in addition to this open-text field (often called a "bio"). On Lex, if a user does not explicitly describe their gender in their profile or posts, other users will receive no indication of their gender and will only be able to infer gender through implicit cues (e.g., profile pictures, usernames, etc.).

*4.1.2 Gender Categories.* While gender labels were largely cosmetic, we found that dating apps largely employ gender as a technical affordance for matching users. *Gender categories* are the data by which users are grouped by the app, often in support of gender-based dating pools.

Many platforms separated labels and categories into two data fields. Almost every app with gendered dating pools has a more restrictive set of gender categories than gender labels; if users select a gender label that does not exist within the gender categories, they are then forced to select a gender category. How many gender category options existed varied by app.

The first style of gender category options was a strict binary gender classification. Apps with this approach required all users to categorize themselves as either men or women (typically phrased as "man" and "woman," or less often as "male" and "female"). In some cases, the apps were designed to allow users to select more expansive options in the gender labels, yet also forced users to choose a binary gender category. As of 2023, Tinder was the only app that still forced users to select from

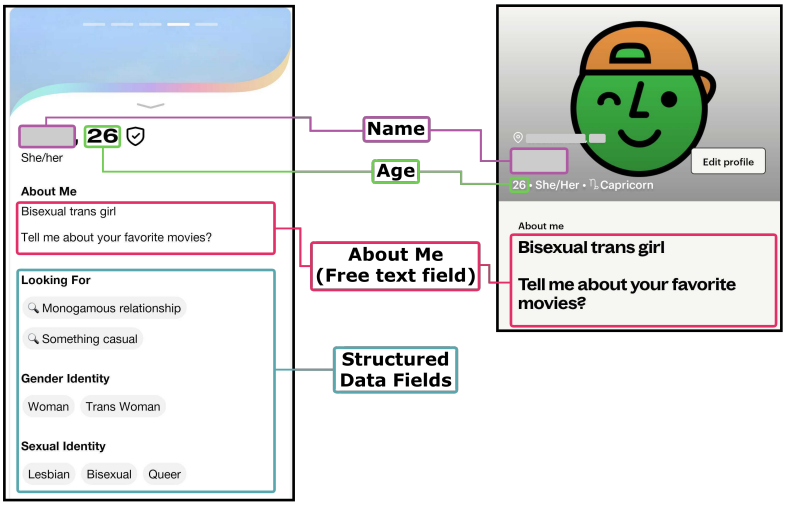


Fig. 3. Example profiles on Her (left) and Lex (right). While Her captures gender and sexual identity as structured data fields, users also have the option of describing their identity in their 'About Me,' a free text field. As Lex lacks structured data fields such as gender identity and sexual identity, users can only express their identities within their 'About Me' section.

| | *Gender Categories* | | |
|---|---|---|---|
| | *Number of Responses* | *Response Options* | *Separate from Gender Label* |
| *Tinder* | Single | Binary | Yes |
| *Bumble* | Single | Trinary | Yes |
| *Hinge* | Single | Trinary | Yes |
| *OkCupid* | Multiple (5) | More than 3 | No |
| *Facebook Dating* | Single | Trinary | No |
| *Her* | Multiple | More than 3 | No |
| *Taimi* | Single | More than 3 | Yes |
| *Grindr* | Single | Trinary | No |
| *Scruff* | Multiple | More than 3 | No |
| *Lex* | Not recorded | Not recorded | Not recorded |

Table 3. Features seen in gender categories, including number of allowed responses, number of potential response options, and whether gender categories were a separate data field from gender labels. Gender categories are distinct from gender labels, although many apps present them to users as if they are the same.

a strict binary gender classification [8]. On Tinder, users can select "non-binary" as a gender label (which will appear on their profile), yet doing so takes them to a page requiring their account to be grouped with either users who chose "men" or users who chose "women"—the technical equivalent

[8]Bumble, which had previously only had binary gender categories, changed in 2022 to include a non-binary gender category

of asking someone if they are a "girl non-binary" or "boy non-binary."Anyone with a gender identity outside these two category options would be forced to misrepresent—and misgender—their gender identity.

More inclusive than binary gender categories, several apps had trinary gender categories: "men," "women," and "non-binary." While it might initially appear that including a third gender category could avoid excluding all non-binary users, "non-binary" still collapses all non-men and non-women into a monolithic category. For example, on Hinge, a user can find "genderfluid" in the gender label search bar. However, after selecting "genderfluid" the user is still to group themselves with either the "men," "women," or "non-binary" categories, none of which may be accurate.

Finally, we saw gender categories with more than just three options. For example, Taimi provided "man," "woman," and "non-binary" categories, as well as "trans man" and "trans woman" categories. While laudable, when presented with these options, it is clear that people could easily be categorized as more than one of these options. Taimi's approach raises questions about why app users are restricted to only one gender category.

Regardless of how many different response values an app has for gender categories, most apps limit users to choosing a single response at a time. OkCupid was the only app that allowed users to select multiple gender categories at once, affording users the freedom to present a more nuanced, multi-faceted gender identity. For example, someone who is a non-binary woman can select both the "non-binary" and "woman" categories and be found by users searching for either women or non-binary people.

*4.1.3 Gender Labels x Categories: A Grouping Problem.* In the prior subsections, we described two dimensions of gender in dating apps: gender labels and gender categories. Though in some cases labels and categories have two distinct data fields, they are often presented to users as a singular data prompt and only become visible to the user when selecting a gender label that did not exist as a gender category. Typically, labels were either hidden on a separate page as "more options" or presented additional information directly appended to their gender category. As such, these two forms of gender are often interdependent in some way. Choices made by the user when selecting a gender label often shaped what gender category they could select, and vice versa.

In some cases, gender categories came before labels. In these apps, users first selected a gender category and then were given the option to add more detail through the additional selection of a gender label. In these cases, the gender category took precedence and was required for a user to make a profile regardless of whether or not the user decided to add a gender label. For example, a user might select the category "man" on Taimi, and then be given the choice to add more details in the form of the labels "cis man," "trans man," or "intersex."

Some apps prompted users to select a gender label first, which would often restrict the categories one could be grouped with. For example, on Facebook Dating, if a user selects the label "trans woman" then the user can choose to be categorically grouped with "trans women," "women," or "everyone" for matching. However, they were automatically locked out of being grouped with "men," "trans men," and "non-binary."

In other cases, gender labels and gender categories were not as interdependent. On Tinder and Hinge, a user who chooses to select a gender label from amongst the "more options" can choose any combination of label and category. However, even in these cases labels and categories are not entirely independent. When a user does not choose to peruse more gender options from the gender selection prompt, their choice of gender category is automatically used as their gender label.

Finally, on some platforms, the same data field was used for both labels and categories, with labels being co-opted for categories. In other words, whatever a user selected as their gender label was also adopted as a technical category for matching. Unlike many apps, where labels and categories

were merely presented as a singular data field, on some apps they were one and the same. On OkCupid, for example, when a user selects "trans man", it is used as a cosmetic label on their profile as well as a data point by which to group them with other "trans man" users.

### 4.2 Sexuality

Similar to gender, sexuality was also represented in two distinct ways on dating apps. The first was with a "sexual orientation" label; the second was by asking users who they are "interested in." In the following sections, we use three terms to refer to the ways sexuality is conceptualized in dating apps:

(1) **Sexuality**: The identity held by a user outside the restrictions and context of the app.
(2) **Sexual orientation labels**: A form of sexuality data that describes a user's sexuality in terms of commonly known identities.
(3) **Interested-in categories**: What gender(s) of people the user wants to see, which often serves a critical role in gendered matchmaking.

Unlike gender, we could more easily identify the two data inputs of sexual orientation and interested-in genders as they were collected in clearly different prompts and views. We add the label and category nomenclature for consistency with gender labels and categories based on the roles played by labels on profiles and by categories in matching.

These approaches were not mutually exclusive. Within our apps, we saw examples of designs with both, one, and neither of sexual orientation and interested-in categories.

*4.2.1 Sexual Orientation Labels.* Much like gender labels, *sexual orientation labels* were qualitative labels to further explain one's sexuality. However, unlike gender labels, sexual orientation labels were rarely ever used beyond the profile. The only examples of sexual orientation being used in support of matching were on Tinder, to sort users already appearing in their dating pool, and OKCupid, as one of dozens of factors in calculating a compatibility percentage used for sorting profiles within a dating pool. In both instances, sexual orientation labels appear to act only to prioritize certain users who are already categorically acceptable.

The most common approach to sexual orientation labels was to simply not have them at all. Half of the apps we examined did not have sexual orientation labels (Bumble, Facebook Dating, Grindr, Scruff, and Lex) [9]. On apps that have no fields for sexual orientation labels, users may choose to include their sexual orientation in an open-ended profile field, such as the bios discussed in Section 4.1.1.

Among apps with sexual orientation, we saw apps vary in how many sexual orientation labels were offered. As a result, users might find their identity cannot be captured in this data field.

On apps that offer sexual orientation label fields, the primary difference we observed was whether users could only select one or multiple labels at a time. On the three dating apps that allowed for multiple selections, there was a variation in the number of simultaneous allowed responses. Some apps allow users to simultaneously select every single option (e.g., Her). Other apps had limited users to three (Tinder) or five (OkCupid) simultaneous responses.

By allowing users to select multiple responses, users are not forced to overly simplify their identity to only one reductive label. For example, a woman on Her may select both "bisexual" and "lesbian." Multiple labels can signal more nuanced aspects of sexuality. For example, by signaling that a bisexual user embraces terms such as lesbian, signaling that she does not generally date men, signaling that she experiences more attraction towards women, etc. Of course, the full nuance of that user's sexuality will not be fully communicated through any number of sexual orientation

[9]Taimi added sexual orientation labels in 2023

| *Sexual Orientation Labels* | |
|---|---|
| | *Number of Responses* |
| *Tinder* | Multiple (3) |
| *Bumble* | Not recorded |
| *Hinge* | Single |
| *OkCupid* | Multiple (5) |
| *Facebook Dating* | Not recorded |
| *Her* | Multiple |
| *Taimi* | Single |
| *Grindr* | Not recorded |
| *Scruff* | Not recorded |
| *Lex* | Not recorded |

Table 4. Features seen in sexual orientation labels, specifically how many responses may be recorded.

labels; that would require a user to elaborate on their identity in their bio. Still, the use of two sexual orientation labels communicates far more nuance than being forced to adopt a single label would.

*4.2.2 Interested-In Categories.* In addition to sexual orientation labels, dating apps also employ sexuality for algorithmic matching by asking users what gender(s) of people they are "interested in." If sexual orientation labels are a counterpart to gender labels, *interested-in categories* act as a counterpart to gender categories. The interested-in categories create functional data that is central to the gendered matchmaking at the core of most dating apps. Interested-in categories act as a functional proxy for sexual orientation.

One design of interested-in categories was easily the most popular: using the same allowed response values for gender categories as interested-in options (e.g., "man" could be both a gender category and an interested-in category). Indeed, only one app which had interested-in categories did not take this approach. The one difference we saw was that regardless of whether the gender categories allowed only one or multiple responses, interested-in categories always had multi-response options (and sometimes an "everyone" option for simplicity) to enable people with multi-gender attraction to be able to see more than just one gender at a time. We saw this approach in Tinder, Hinge, Bumble, OkCupid, and Taimi.

Facebook Dating was the only dating app that had interested-in categories (and by extension, gendered matchmaking) that did not directly use gender categories for their interested-in categories. Most of the allowed responses for both were the same, with one major exception. While users could select "non-binary" as a gender category, Facebook Dating does not allow users to select "non-binary" as an interested-in category. Through experimentation, we found that users who select the "non-binary" gender category only show up to users who selected "everyone" for their interested-in category. We found this design odd, especially given the way other permutations are supported. For example, while users who had selected either "man" or "woman" for their gender could not choose to see trans people specifically, users who chose "trans man" or "trans woman" as their gender category could specify that they want to see "trans men" and "trans women"

| | *Interested-In Categories* | |
|---|---|---|
| | *Allowed Responses* | *Same allowed values as Gender Categories* |
| *Tinder* | Binary | Yes |
| *Bumble* | Trinary | Yes |
| *Hinge* | Trinary | Yes |
| *OkCupid* | More than 3 | Yes |
| *Facebook Dating* | Trinary | No |
| *Her* | Not recorded | Not recorded |
| *Taimi* | More than 3 | Yes |
| *Grindr* | Not recorded | Not recorded |
| *Scruff* | Not recorded | Not recorded |
| *Lex* | Not recorded | Not recorded |

Table 5. Features seen in interested-in categories, including how many response options exist and whether they are the same as that app's gender categories.

respectively. Yet even users who select "non-binary" as their gender category cannot choose to be interested in "non-binary" users.

Not all apps had interested-in categories. Interestingly, the four apps that did not have interested-in categories were queer-focused: Her, Grindr, Scruff, and Lex. These four apps are also the only ones without a gender-driven matchmaking system.

Taimi was the only queer-focused app that asked users to fill in an interested-in category. Taimi was also the only queer dating app that aimed to include all queer and LGBTQ+ people, rather than focusing specifically on MLM[10] (e.g., Grindr, Scruff) or WLW (e.g., Her, Lex). These apps assumed users would all be basically a single gender with same-gender attraction and thus would not need to filter out large numbers of users based on gender alone (such as heterosexual men filtering out all men). Though this reduces non-binary users of a platform to being functionally the same as men or women depending on the app's primary demographic, it also allows the app designers to forego a mechanism for gender-driven matching.

### 4.3 Gender x Sexuality: Algorithmic Dating Pools

On every single app, even the simplistic Lex, users filtered which other users (or their posts) they wished to see. While other factors—such as age and location—are also used in filtering, here we focus primarily on how dating apps use the combinations of gender categories and interested-in categories to create dating pools. Through the creation of dating pools, gender categories and interested-in categories are transformed from seemingly static artifacts for describing users to dynamic affordances aimed at connecting users.

The synthesis of both gender categories and interested-in categories for gendered dating pools may best be illustrated through a hypothetical scenario. The first step taken within an app is to compare a user's selected interested-in category with the gender categories selected by other users. For example, the primary user at hand, whom we will call Katie, indicates on their account that

[10]Men-loving-men, a term for men who are attracted to other men, which includes both gay and bisexual men.

they are interested in "women." The dating pool is thus narrowed down to include only the gender categories that the user is interested in, which in our scenario is those who chose the gender category of "woman."

Next, the matching algorithm considers Katie's gender category selection and other users' interested-in selections. For example, Katie may select the category of "woman." Though Katie is a "woman" who is interested in other "women," those "women" who are only interested in "men" (i.e., heterosexual women) would likely not want to see Katie. From here, the matching algorithm would identify and group users with the gender category of "women" who are also interested in other "women." Thus, Katie's dating pool would be a series of users categorized as "women" who are interested in "women" (and perhaps other gender categories).

Through this example, we can see how dating apps take the concepts of both gender identity and sexuality and collapse them into components in a sorting function—through the process of reducing gender into categories and labels, and proxying sexuality with interested-in, almost always ignoring labels entirely. Of course, these algorithms are obfuscated by a black box, and we can not determine the exact order of steps taken by the algorithm, nor can we be confident that other factors do not contribute to recommendations. However, by testing different combinations of gender and sexuality-related data and observing changes to algorithmic dating pools, we can infer the role of the data values described in the above example.

Of course, as we described in Section 4.2.2, four apps did not have a gender-based dating pool. These platforms do not need to ask users their gender categories or interested-in categories as gender was not considered in matching. Instead, these four apps make presumptions around the demographics of their users (MLM for Grindr and Scruff, WLW & non-binary people for Her and Lex), assuming that people outside the targeted demographic will not use the app. In other words, a cishet man does not likely sign up for Her, and if he does, he will likely not be successful with that user base and choose to leave. Any gender who would need to be filtered out by the primary demographic would be filtered not in any algorithmic function of the app but through their own choice as a result of the app's stated purpose, marketing materials, and current demographic.

## 5 Discussion: Four Layers of Identity in Dating Apps

While one might assume how identity is constructed on dating apps is straightforward, our findings demonstrate that it is complex – and often contradictory. Identity is enacted in an entangled system of data artifacts (i.e., specific, calcified data points as would populate a database) created by responding to various data prompts each with different uses and constraints. These artifacts, as a whole, create the app's technical representation of a user's nuanced, multi-faceted identity and are used by functions of the app's profile creation and algorithmic profile curation. This entanglement makes it challenging to pin down what identity in dating apps actually is. What are the identities that can currently be modeled within a dating app? How are these identities used within the functions of these apps? When an identity cannot be modeled, how are users with that identity excluded or misrepresented? How can we disentangle and see the different ways identity is operationalized and experienced?

For example, we found apps like Her that, while seemingly inclusive – enabling users to select from a dozen gender identities – made little use of that information. Instead, such apps relegated gender to a cosmetic feature on a profile – information that could already be displayed as free text. At other times, we encountered apps like Grindr that support diverse gender options, but that did not reflect (or went far beyond) their user demographics and the common understanding of who that app is intended to serve (in the case of Grindr, gay cis men). In other cases, we found apps like Tinder that appear to honor diverse gender identities, only to then ask users to categorize themselves into reductive groups, leading to a double encoding of gender (for instance, as both

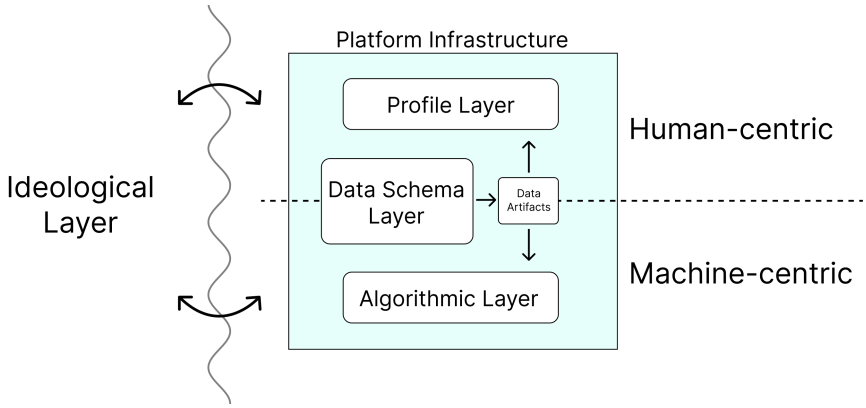


Fig. 4. Relations between layers of identity management. The data schema layer is accessed by the profile and algorithmic layers via data artifacts (e.g. a user's gender data). The profile layer is primarily visible to human users, the algorithmic layer is primarily visible to the app, and the data schema layer straddles human and computer visibility. The ideological layer shapes, and is shaped by, the dating app as a whole.

non-binary and either man or woman). Apps like these appear to be inclusive on the surface yet were not *functionally* inclusive.

A purely data-centered view is reductive and cannot sufficiently explain the full range of how identity manifests and moves through an app. A purely user-centered view cannot sufficiently account for how identity is captured and utilized for matchmaking. The diverse ways apps capture and make use of identity data highlight how data and interaction design are often entwined in non-intuitive ways. To support more inclusive dating app design, we present a framework that disentangles the layers at which identity is shaped and used. Specifically, we argue that identity can be understood across (1) a Data Schema Layer; (2) a Profile Layer; (3) an Algorithmic Layer; and (4) an Ideological Layer.

In the rest of this section, we describe each layer in detail, after which we demonstrate the utility of our framework by applying it to a dating app hypothetically looking to improve how it supports queer users.

### 5.1 Data Schema Layer

We conceptualize the *Data Schema Layer* as where user data is captured and structured. The data schema of a dating app is where social identities become calcified into a data artifact that is supported within the data ontology of the platform. For example, the societal concept of sexuality, which is often fluid and context-dependent, is calcified into a data point with values such as "bisexual" or "lesbian." The data schema layer encompasses the collection of data fields that users are prompted to fill out and their possible responses. As demonstrated throughout our findings, data schemas vary more than one might imagine. We found apps that employed two functional gender categories (e.g., Tinder) to those that employed twenty-two (e.g., OkCupid); we found apps that schematize sexuality into a predefined set of categories (e.g., Bumble) and those that did not try to capture sexuality at all (e.g., Lex). Each of these choices had downstream effects.

In our analysis, we saw that gender, in the form of categories, is often crucial to apps' underlying matching algorithms. Apps with gender categories require users to select one or more genders when creating an account. Likewise, identities that are absent from the data schema cannot be considered by a matching algorithm, leading to a systematic exclusion of those who fall outside of

the available categories from all data-driven processes of the app. A clear example is in the case of Her. Her's target audience is everyone except cis men. A cis man may download the app—he may even make an account—but the identity of "cis man" does not exist within the data schema. To complete his profile, this cis man would have to lie about his gender, making his identity as a cis man computationally invisible. Effectively, cis men do not exist in the computational ontology of Her. In instances like the forced binary gender category response on Tinder, the inability for non-binary or other gender diverse users to accurately and wholly represent themselves in a dating app enacts torque on the user who is forced into a classification that is inaccurate [9] and has downstream impacts on the interactions and experiences they can have on the app.

Therefore, we encourage researchers and practitioners to consider how the data schemas they employ might negatively impact the experience of identity throughout the dating app, especially when designers add queer identities post hoc to an existing schema. In particular, designers should consider how the data schema layer might limit the dating pool underlying the very purpose of dating apps for those who fall outside the selected fields. While researchers and practitioners might consider expanding the options in these data schemas, they might also consider approaches that we did not see in our data—such as allowing multiple identities to co-exist within data schemasand employing recommender systems that do not rely on data fields explicitly.

### 5.2 Profile Layer

The *Profile Layer* is the primary site of self-presentation and where data captured in the data schema layer is displayed to other users. The profile consists of a combination of both structured data (e.g., sexual orientation labels) and unstructured data (e.g., bio), allowing users to communicate their interests succinctly and mutually intelligibly as well as provide additional context when needed.

Users make choices about what data to display or not on their profile to appeal to prospective partners. There are often many structured data elements that transfer to the profile layer. On most apps, data fields the user populates are displayed on the profile unless the user decides they should be hidden. Conversely, some apps may choose to hide certain data responses by default (e.g., non-cis genders on Hinge), but give users the option to display them if they so wish. Regardless, much of the user's public-facing profile appears as a direct reflection of the data prompts they answered, and is often able to display selected gender and sexual orientation labels, which typically have more diverse options to choose from. In the case of Tinder, the profile layer would give users the option to display a gender label such as non-binary or trans woman. These structured points, and the limitations they inherit from the data schema layer layer, highlight the value of unstructured data in the "bio" field.

The information that users choose to share in their bio can help in presenting a more complete vision of themselves, and it is especially important for queer users who do not neatly fit into the app's structured data schemas. Users with non-normative genders or sexualities can use a bio to more comprehensively describe complex, multi-faceted identities. What is written in their bio is left up to the user. Unlike categories and labels, there is no concern for how responses fit into a schema: the bio is an unstructured text field.

However, bios can be misinterpreted. If someone uses terminology too specific and niche, the majority of users will not understand what it means. This may indeed be seen as a positive: some terms that may appear on profiles only hold meaning to other members of a community [32], and thus can serve to signal identity in a less obvious and outting way (c.f., [1]).

The more designers rely on the profile for inclusion, and the flexible self-disclosure of the bio, the more they shift labor onto users and leave open the door to misunderstanding, and leave room for frustrations of self-presentations discussed in prior work [2, 6, 11, 20, 46]. Reliance on humans reading the bio leaves room for misinterpretation or misunderstanding of identities, which would

primarily impact users with non-normative identities as they are far less commonly understood than normative identities such as man or woman. Effectively we see a design trade-off: While open-ended identity attributes are likely more prone to misinterpretation, standardized labels are more likely to have shared meaning and interpretations across a user base, but are inherently reductive.

Designers should consider the degree to which they rely on the profile to support diverse identities. Profiles, though enabling users to present their identity with full nuance, require active engagement from other users and ultimately create a higher burden on users to present themselves and interpret others. We suggest designers examine and reflect on what data is collected but ultimately only used within the profile, and consider if this data can be utilized by other processes to make reading and interpreting profiles less critical for users with diverse identities.

### 5.3 Algorithmic Layer

We refer to the algorithmic work of creating dating pools and presenting users with potential matches as the *Algorithmic Layer*. We often saw how the typical application flow broke down for non-binary or gender-diverse users as a result of gender-driven matchmaking processes. In our Tinder example, the algorithmic layer uses the binary gender category created when a non-binary user has to select to be grouped with either men or women, rendering any other gender identities invisible to the matching algorithm.

The algorithmic layer is shaped by the data schema that defines what categories of people can exist within an app and what information is available for use in determining who should be shown to whom. First, the user's dating pool is curated by the app. Each user's dating pool is produced using their selections in the data schema layer, encompassing not only their identity categories (e.g., gender) but their preference selections (e.g., age range). The user then engages with this dating pool through the actions of seeing and swiping through queues (e.g., Her) or grids (e.g., Grindr) of profiles that "match" the user's preferences.

The algorithmic layer does not always use the data that would seem most relevant. For example, while sexual orientation might seem central to matching (indeed, in the real world, sexuality is crucial to figure out before trying to date someone), we found that it was rarely more than a cosmetic data point for the profile. Instead, the algorithmic layer used interested-in categories as a proxy for sexuality. Even more consequential was gender. We often found that the algorithmic layer used gender categories, which often had fewer options, while overlooking gender labels, which despite having more options were relegated to the profile layer.

Many of the issues we described for the data schema layer have implications at the algorithmic layer. Some users are prompted—even required—to select gender categories they do not identify with to access a dating app's matchmaking process. In the algorithmic layer, these selections then become tangible to others in how apps include and exclude users from the dating pools shared with others. Further, how a dating pool is curated relies on the limited identity options operationalized in the data schema. If a non-binary person were to select to be shown with women, and then select they are interested in everyone, their dating pool would include men seeking women. This can potentially lead to misgendering. For example, a man, having selected he is only interested in women, may reasonably assume everyone he is shown identifies as a woman even while apps like Tinder are also showing him non-binary "matches." Conversely, desired people may slip through the cracks: if a user is interested in men and non-binary people, but not women, they may well select to only see men, thereby missing all non-binary users who selected to be shown with women.

In the absence of algorithms, however, apps rely on users to carefully read profiles and decide on a match. While gender and sexuality fields may be defined in restrictive ways, doing so allows the work of identifying potential matches to be offloaded onto an algorithm, making the entire

experience of dating apps less taxing and allowing users to peruse many more profiles. Therefore, we see a trade-off between the labor reduction and efficiency of leveraging an algorithm and structured data artifacts to curate dating pools versus relying on human interpretation and decisions alone.

Designers should consider the social engagement they are implicitly embedding into the user filtering approaches. To avoid inaccurate assumptions that result in poor user interactions like misgendering, they might consider different ways of displaying user characteristics. After all, those who selected that they were interested in "women" are likely to assume all the users showing up in their dating pool are women. Designers should also consider other possibilities for creating dating pools. While one approach to the issues with gendered dating pools might be to remove consideration of gender when creating dating pools (as done on Her), this does not address the issues people have with dating pools oversaturated with poor matches. Practitioners might consider more nuanced ways of filtering and sorting so users can better curate their matches. They might also consider more machine learning-driven options for curating dating pools, less focused on categorical matching using cisnormative data schemas. Since relying on strict schemas for gender can restrict users' functional identities, finding alternative ways to make matches would lessen the functional impact of those categorical limitations.

### 5.4 Ideological Layer

In the previous layers, we described how identity attributes are operationalized and made use of within the app. However, there were still gaps that the three layers we have discussed did not sufficiently explain. Consider Grindr, which has a data schema that supports women gender options, profiles that users can fill in with whatever gender identities they wish, and no gender-based profile curation. So then, why is the app almost exclusively used by cis gay men? Rather than being a consequence of any technical design choices, the lack of women on Grindr can be seen as a result of the app's social reputation as a gay male hookup app.

We formalized the social and cultural factors that surround an app's development and use, as the *Ideological Layer*. Being comprised of the general social attitudes and marketing about an app, the ideological layer shapes identity in implicit ways by influencing the assumptions and focus of potential users. Though the ideological layer exists outside the technical infrastructure of the app, ideological influences are not completely absent from the technical infrastructure of dating apps. The ideological layer shapes the use cases an app prioritizes and the user personas designers would prioritize.

Gender on Her is a clear example of the ideological layer at work. Her has a clearly stated non-cis-male target population – even the name "Her" reinforces a focus on women. Before ever downloading the app, the marketing materials and screenshots would discourage users who identify as men from using the app. Therefore, the identities held by the majority of users creating an account will be women. This ideology is reflected in the data schema layer by allowing users to select genders like "non-binary" and "trans man," but not "man" or "cis man."

The impact of this layer is especially apparent for queer-focused dating apps, due to being specifically made for and marketed to members of the LGBTQ+ community. LGBTQ-focused dating apps often define who the platform will work for, not in data schemas or code, but through marketing materials and reputation. Images in the app store of the app and its users are seen long before one ever encounters the data schema layer.

Yet, the reputation of an app may vary between locations, age groups, over time, and even within friend groups. App reputations can shift independent of changes to their design and vary across geographic areas, as can their user bases [2]. Therefore, the ideological layer is more context-sensitive than other layers.

The ideological layer asserts its influence by setting expectations of who should be on an app. Unlike the hard exclusion seen in the data schema layer, the ideological layer only softly excludes people, making the app appear less welcoming for certain groups rather than firmly dictating who is or is not allowed to make a profile. Soft exclusion can be seen and embraced as an asset for creating a safe space for queer people on LGBT-focused apps. There is a long history of queer bars and other physical LGBTQ+ spaces building safe queer spaces through the soft exclusion of cishet people [25]. If we accept that no app should be all things to all people, the ideological layer can make it clear who a given app is for, even if designers choose not to exclude specific identities in the data schema layer.

### 5.5 Framework Utility

Through analysis of our data, we developed a framework for understanding how identity manifests in four layers of app design: Data Schema, Profile, Algorithmic, and Ideological. The data schema, algorithmic, and profile layers are central to how identity is shaped and used in an app. The schematization of identity data in these layers has a direct impact on how users can identify in an app. The information in the data schema layer is leveraged by the algorithmic layer, where the automated creation of dating pools by a black-box algorithm reflects and reinforces identities by filtering users based on their selections in the data. The profile layer displays data structured in the data schema layer alongside unstructured free text, affording a user the ability to personalize their profile and provide context to the predefined categories, if needed. However, the identity presented within the profile layer is primarily visible to other users rather than the underlying algorithmic layer powering the matching system. Finally, the ideological layer shapes common understandings of who an app serves, which sometimes is reflected in the actual design of the other layers.

By disentangling how identity is used in these four layers, we argue that designers and researchers can better understand the different technical and social forces exerted upon user identities. Teasing apart identity in these four layers enables designers and researchers to more accurately identify the source of tension points. These layers help to disentangle social and technical elements comprising how user identities, especially those relating to gender and sexuality, are being structured, reproduced, utilized, and presented, and allow us to pinpoint where points of intervention should be. This framework can also help designers identify where problems originate and where interventions to support users with non-normative identities are most needed and would be most effective.

Our example of Tinder helps show the value of this framework. If one wanted to improve the ability of non-binary people to access the app without reducing their identity, the initial instinct might be to change the data structure, but this does not fix the problem. The current case of double collection of gender Tinder can be seen as an effect of such an intervention that overlooks the complex and iterative connection between the data schema layer and algorithmic layer. In our findings, we saw that apps that collected gender twice (gender labels from a more inclusive set of options and gender categories from a restricted set of options) tended to have a gendered dating pool based on the more restrictive set of gender options. It is likely, if speculative, that this is a consequence of a continually evolving platform. If, initially, an app such as Tinder only had the genders “man” and “woman” in its data schema, the original profile curation algorithm reasonably would have been built around these binary categories. If, when designers began to include additional inclusive gender choices, they did not have the bandwidth, desire, or permission to overhaul dating pool creation, it would be sensible to add inclusive genders as a separate data point which, despite existing within the data schema and being optionally visible on the profile, is not seen by the matching algorithm. Therefore, the original binary gender data field continues to exist to support this unchanged algorithm. Without gendered dating pools created based on diverse gender options, the app would not need to collect a more standardized gender data point in addition to the more

inclusive gender value. Using the layer framework to disentangle the reductive issue of Tinder asking non-binary people to essentially choose a singular binary gender to be grouped with, we can see that the issue lies not with the data schema itself, but with how the algorithm is designed to require a binary data field.

## 6 Future Work

We see two important directions for future work. The first is to more accurately understand how trans and non-binary people experience tensions within dating apps and the limited identity expressions therein. While we have discussed similar literature about dating apps and queer users (see Section 2.1), it has not focused on the subjective experience of navigating exclusive or reductive data structures and algorithms. Throughout our findings and discussionpoints where users would struggle or feel limited were primarily identified through the lens of our own experiences as queer users of dating apps and the experiences of our networks. For the wider queer and trans population, these points of tension may prove to be incomplete or unfounded. Therefore, interviews with trans and non-binary participants that identify where they experience tension in dating apps are crucial, and would also allow us to better understand what types of tradeoffs between structured data and human/algorithmic labor they are willing to make. Future work should focus on the subjective experience of trans and queer users as they navigate through identity-related actions on dating apps.

Second, it is worth exploring what dating apps might look like without gender and/or sexuality. The majority of the apps we examined had a gendered (i.e., dependent on user information) dating pool, either as the result of algorithmic gender filtering or ideological limitations of the user base. Those apps that did not have a gender-centric dating pool often had no sense of algorithmic curation or filtration on the dating pool at all. We question, then, what an ungendered, algorithmic dating app would look like. Could a dating app without any data ontology about gender, sexuality, or queerness as a whole incorporate some algorithmic recommendation system to provide potential matches without considering gender and sexuality?

As we were analyzing our findings, the research team discussed and imagined a few potential ideas for an ungendered dating app. We believe that a simple app design would be an app in which every user would be shown to every other user – without algorithmic recommendation. That is, there would be a universal dating pool as was seen in Her. On dating apps without a strong ideological component shaping the user base, the demographics commonly seen on dating apps would mean that most profiles a given user sees would be cisgender, heterosexual men. In the case of this design, the need for identity signaling by users, especially queer women as discussed by [20], would be intensified, and ultimately lead to more labor by queer users.

The next design we considered would leverage a $k$-nearest neighbors algorithm to recommend profiles. We imagine that swiping behavior could be used to calculate a user's "type," and that dating pools could be populated based on other users with similar swiping behavior. While this algorithm would allow for suggested profiles without having to consider any individual data points within a profile, KNNs have a baseline time complexity of $O(n^2)$, which is very poor at scaling. Additionally, if the distance calculation calculates the difference in each past swipe, past swipes theoretically approaches $n$ and thus leads to an effective time complexity of $O(n^3)$, which is even worse if scaling to an app with the popularity of Tinder, for instance. Furthermore, due to the geospatial element of dating apps, this method may not work well for users in rural areas where there are few comparable users. There also exists the potential for feedback loops wherein more conventionally desirable users receive more likes, and would thus be shown more often. In combination with the fact that Black women receive far fewer likes than white women [10], there is a strong potential for further marginalization and exclusion of people of color, especially women.

We also considered an app that groups users based on character or identity traits besides gender identity, such as gender expression. From this idea of classifying users by their gender expression, that is, the visual appearance of masculinity, femininity, and/or androgyny, we considered circumventing the collection of gender by using computer vision to classify users and create dating pools based on visual identity. While this may be tempting, as it would mean users do not see gender as a data field and the app would appear ungendered, it would merely bake in gender on the back end in a more hidden and therefore less manageable way. Furthermore, Scheuerman et al. have shown that computer vision algorithms under-perform at classifying trans people and are wholly incapable of correctly classifying non-binary people [37] (c.f., [26]). Additionally, even if classifications of gender were done algorithmically, users would still need to provide their sexuality to determine which gender(s) of other users to show them.

Exploring such approaches would enable designers to imagine dating apps that are less reliant on structured data, which is inherently reductive and will always limit some marginal identity, no matter how many specific options are allowed. Furthermore, they may allow dating apps to more reflexively understand and support users based on their shifting actions rather than relatively static identities calcified into data. These approaches may better account for the fluidity often seen in queer identities.

In addition to future work focusing on dating apps, we encourage other researchers to explore the applicability and usefulness of our four-layer framework in other types of apps, such as social media. We believe these layers may help identify tension points in other systems that handle identities in both human-centered contexts (e.g., the profile layer) and machine-centered contexts (e.g., the algorithmic layer).

## 7 Conclusion

Dating apps have become a staple of modern dating. Prior research has identified many issues facing users of dating apps, yet less attention has been paid to the specific issues surrounding queer users with identities outside the cisgender, heterosexual norm and how the designed interactions of the apps may break down for them. Therefore, we conducted a critical analysis of dating app systems and structures, where we examined how dating apps translate gender and sexuality into structured data that power the algorithmic matching central to dating apps. We found gender and sexuality structured as cosmetic labels often used to populate the profile and functional categories, which primarily served to create dating pools of users to be shown by the app. Limitations with how gender and sexuality data is structured led to normative assumptions about identity that constrain and often exclude queer users.

From our Findings, we identify four layers of identity across which identities are shaped and used within the sociotechnical ecosystem of dating apps. In the data schema layer, identities become calcified within the constraints of a developer-designed ontology; in the profile layer, users display to one another both structured data points and use the unstructured data in their bios. In the algorithmic layer, the app's matching algorithm sorts users based on structured data artifacts previously captured in the data schema layer and determines which users should be shown to one another. Finally, in the ideological layer, the broader societal understanding of the app's purpose shapes user behavior and often results in softly excluding certain demographics.

We do not assume that these layers are necessarily intentional nor that they are how the app designers consider user identity. Rather, these layers serve to demonstrate different aspects of a larger socio-technical dating app system which impacts the identities which tend to appear on a dating app, and how those identities are formed and presented to others. We use these layers to identify different points at which queer users are given affordances to control their identity and the

different effects these capabilities may have on users. Further, these layers allow for an expanded understanding of how user identities are made manifest beyond just structured data.

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